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# HACKERS AGAINST NATURAL DISASTERS: accustoming people to risk

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Gaël Musquet trained as a meteorologist. His early working life as a civil servant saw him develop a passion for hands-on work and cartography. In 2011 he was one of the founders of OpenStreetMap France. In 2016 he set up Hackers Against Natural Disasters (HAND), a nonprofit group that sets out to use available technology tools to improve responses to natural hazards.

## KEYWORDS

- CARTOGRAPHY
- HACKERS
- DISASTER SIMULATION
- TECHNOLOGY VOLUNTEERS

Guadeloupe, a French territory in the Caribbean, is one of France's regions most at risk from natural disasters. The archipelago faces six categories of natural risk – hurricane, flooding, earthquake, volcanic eruption, tsunami and landslides – that are features of life in all islands of the Caribbean. In 2016, Hackers Against Natural Disasters was set up with the primary aim of increasing resilience to these cyclically recurring threats. Every year since its creation HAND has participated in Caribe Wave, an annual tsunami simulation exercise held in the Caribbean region. HAND's contribution to this exercise involves developing innovative digital tools that are accessible to everybody. The goal is to be able to provide locals with effective early warning prior to disaster striking, and to restore power and communications (social media, amateur radio and smartphone apps) as quickly as possible. HAND's vision is built on the idea that everybody – men, women and children – are vital components in building a more resilient society.

## INTRODUCTION

*Founded in 2016, Hackers Against Natural Disasters (HAND) is a French-registered nonprofit organization. Its members are hackers, makers and doers, all driven by a willingness to use their skills, knowledge and determination to help their cause: using information and communication technologies to increase people's preparedness for cyclical natural disasters. This goal has become a doctrine that was inspired by, and evolved from, three founding texts:*

- 1) Article 3 of the Universal Declaration of Human Rights, which states that: "Everyone has the right to life, liberty and security of person."*
- 2) Article L721-1 of the French Internal Security Code: "Through their behavior, everybody is a contributor to civil security. Depending on the situations with which they are confronted and within the scope of their possibilities, they shall do their utmost to warn relief services and take the initial action required."*
- 3) The Sendai Framework for Disaster Risk Reduction (2015-2030), to which France is a signatory, which encourages better cooperation between residents and local and national governments.*

*The framework sets out to promote people's active participation in their country's security. HAND, as described in its manifesto, seeks to act before, during and after natural disasters. Its primary lever is using innovative collaborative processes to develop new tools used to inform, train and alert local people about the risks they face.*

*HAND is an organization working to improve resilience and raise the place of disaster-awareness in local societies. Despite the important role played by technology, HAND's true ambition is to empower everybody to become valuable actors in ramping up resilience in their community and territory.*

## 1. FROM OPENSTREETMAP TO HACKERS AGAINST NATURAL DISASTERS

In January 2010, an earthquake measuring 7 on the Richter scale hit Haiti. The consequences were devastating: over 300,000 people were killed, and as many injured. The financial cost was equally shattering, estimated at \$7.9 billion, equivalent to 120% of Haiti's 2009 GDP.

This is when OpenStreetMap stepped in. The collaborative digital community exists to create an open map of the world and is constantly seeking new data to enrich its maps. Using the community's cartographical and IT skills, it was able to provide real-time maps of Haiti. Hundreds of technology volunteers all over the world set about assessing the state of the country's roads and bridges, identifying the location of refugee camps, flooded zones, water crossings, and even isolated people in need of help.

The method was very simple. The group analyzed images from satellites and drones overflying the region, and used specialist software to map what they saw and post the results online. All data are open and can be downloaded and modified by anybody. This tool was quickly adopted by international bodies on the ground, among them the World Food Program. This was the first time that a digital community had come together at the international level to collect and share data.

Determined to build on this momentum, French technology volunteers decided to set up a French branch of OpenStreetMap. The organization decided to adopt a collegial governance model with every member having the status of president. The Fondation de France was quick to identify the value of this work and to offer funding.

Working via HOT, its specialist Humanitarian OpenStreetMap Team, the organization responded to a number of recent natural disasters: the oil slick that devastated the coast of Louisiana in 2010; the Sendai earthquake, tsunami and accident at the Fukushima nuclear power plant in 2011; the 2014 Ebola epidemic in Africa; and the 2016 Wellington tsunami. Technology volunteers mobilized on each occasion, whether cartographers, bloggers, journalists or developers.

Once a disaster cell is activated, volunteers provide information that is crosschecked and approved by a second contributor. Their activities are not limited to cartography. Volunteers work to restore the internet and access to technologies. Others are specialists in social media for emergency management, able to repurpose the full gamut of tools provided by the digital industries for use in emergency management. This digital savvy is important for several reasons: alerting local

people, passing back information from reliable sources on the ground, and stemming the spread of false rumors.

As a technology volunteer, most of the work is done remotely. But it very quickly becomes frustrating to be so far away and only intervene for a short time in a post-disaster scenario. The frustration is all the more intense because certain parts of the world face cyclically recurring problems: floods in spring or fall, forest fires in summer, or hurricanes in June and October.

Surely it must be possible to invent more durable solutions? This line of thinking led to a fundamental change of method and the creation of Hackers Against Natural Disasters.

## 2. CARIBE WAVE: A DEFINING EVENT EMBLEMATIC OF HAND'S DEVELOPMENT

In 2011, UNESCO asked OpenStreetMap France to join for the first time in Caribe Wave, a tsunami simulation exercise in the Caribbean. HAND was provided with a set of exercises to run on Guadeloupe, one of the highest-risk zones of any French territory. The islands are prone to volcanic eruptions, earthquake, tidal flooding and hurricanes. A Caribbean tsunami could potentially kill 500,000 people if locals were poorly prepared. For example, secondary accidents could rapidly occur at sea owing to the difficulty of locating the positions of merchant and pleasure craft.

The primary tools used during the first exercise were social media, with everything taking place on Facebook and Twitter. Working from Paris, dummy maps were sent out and dummy evacuations organized as we began counting the dummy victims of a fictitious tsunami. Things at the Paris end worked fine, but there was not much success on the ground. Back on Guadeloupe, the exercise was run by the local prefecture with very little involvement by local people. The exercise ran again each year, using the same decentralized model, from 2011 to 2014.

A radical change of method was rolled out in 2015. A five-strong team traveled to Guadeloupe where they collaborated with a dozen or so local activists: hackers, bloggers, amateur radio operators and community managers. They set up base on a beach on La Désirade, an island 25 kilometers from the main island. Despite the challenging conditions, the team was able to generate the electricity it needed and set up an ultra-high-speed radio network delivered via twin antennae: one on the hills of La Désirade and the other at headquarters.

## The Caribe Wave exercise on Twitter: an earthquake hits the Lesser Antilles



## Caribe Wave 2018 exercise



## Caribe Wave 2018 exercise



The day before the exercise, they sent a message to the prefecture to explain what they were doing. Intrigued by this grassroots initiative, the prefecture nonetheless requested that the team refrain from contacting Guadeloupe as they were worried that people might not realize that the alarms were only a test.

In 2016, for the first participation as HAND, a crowdfunding campaign raised €33,000. A 12-strong delegation set up on Marie-Galante, 34 kilometers from the main island. They set about a highly ambitious program: drone flights, installation of seismic sensors, supervision of maritime and air traffic, development of a cellphone app to guide people to higher land, 3D terrain modeling, transmissions via a long-distance amateur radio network that also provided internet access, and more.

In 2017, the exercise was repeated thanks to funding from Caisse d'Epargne Alpes-Corse, which had acquired Banque des Antilles Françaises and was eager to engage in studies of risk-related problems in regions where its retail banks operated. This time a 16-strong team was deployed. The major innovation for this latest campaign was trialing a new tool to display alerts on car radio displays. The team was also joined by journalists who broadcast dummy reports from the AFP news agency.

A few months later, Irma and Maria struck the Caribbean islands and cut power supplies in Guadeloupe. Without power there is no modern world – no digital tools, no artificial intelligence or big data are available and, most critically, information ceases to circulate. People in the Antilles were ill prepared for such a catastrophic event. They were unable to connect to the internet or use their habitual networks and so they had no idea what was happening beyond their immediate locality. Rumors spread very quickly: attacks, rapes, prisoners on the run, etc.

In Guadeloupe, relationships forged during Caribe Wave exercises created solidarity networks able to report back on the situation on the ground and people's needs. Télécoms Sans Frontières, a French NGO, set about getting communications networks up and running again by installing wifi access points that enabled people in disaster-struck zones to update their families and friends. With the state absent for several days following the destruction of the prefecture, a community of techno-literate residents put their scientific and technical know-how to use for the common good.

Thanks to the existence of this community, HAND did not have to deploy an emergency team to Guadeloupe. But the organization's members did coordinate what was going on as well as send equipment and provide remote advice to their colleagues via a WhatsApp conversation.

After seven years' actions on the ground, the first contacts with local politicians in Guadeloupe came during Caribe Wave 2018. Every local mayor on Marie-Galante island took part in the exercise. Also, the Fondation de France continued to support the initiative, meaning that a 26-strong team was dispatched.

HAND currently operates exclusively thanks to volunteers and it is structured into several hubs:

- **Logistics:** central to all the group's initiatives, it organizes travel, accommodation, meals, equipment transportation as well as all the automobiles, aircraft or boats needed on site.
- **Radio:** comprises three amateur radio enthusiasts responsible for deploying the equipment needed to re-establish contact with the



neighboring islands, countries or continent. They are capable of establishing links over distances ranging from a few dozen to several thousand kilometers; the record is a 6,500-km link from Marie-Galante to Cherbourg.

- **Tourism:** exists primarily to provide reassurance about risks to travelers, a group often among the most vulnerable during a natural disaster. HAND aims to provide training to travel industry professionals and, for example, has already agreed a partnership with the Mercure Hotel on Saint-Martin.
- **Education:** works to raise awareness among students of all ages, from kindergarten to college. We are convinced that young people are the future of resilience. Children are often the best ambassadors for the exercises, performing them even better than adults. HAND works closely with Simplon.co, a specialist provider of digital education. The team at Simplon.co can be called on to create a platform to supervise air and sea traffic in real time, or software to issue alerts to local people.

### 3. RESILIENCE IS ABOUT PEOPLE

Although it might seem that HAND's approach is technology-driven, this is not the case. There is nothing particularly complex about the digital tools used and deployed on the ground. In reality, the strength of the project lies in the community that has grown up around the organization.

Resilience in any given territory comes first from the people who live there and who can become engaged with the issue. The challenge is not technological, it is profoundly political. Today, the culture of risk needed to build more resilient systems is almost – if not wholly – absent. Time is needed to get used to new ideas, if only to inform about risk without provoking needless anxiety.

You can only plan for resilience in times of calm, before disaster strikes. It is important to prepare the ground if solidarity is to prevail post-disaster. In Sendai in 2011, neighbors who already enjoyed good relationships with each other banded together to form the very first networks delivering support and assistance after the earthquake. Japan is an excellent resilience case study, a country where learning about the risk of natural disasters that can strike the archipelago is something that starts at a very early age.

There are three essential phases behind the effectiveness of any resilience strategy.

1. **Inform:** the population must know the risks they face, be it tsunami, earthquake or epidemic. This helps to put dangers into perspective. It is also important to make sure that tourists are made aware of possible dangers when visiting a country. In Indonesia, *Tsunami Ready* signs displayed at hotel entrances alert visitors to possible dangers and certify that the establishment has taken steps to prepare.
2. **Train:** exercises like Caribe Wave help people to learn how to react. This work should start right from early childhood so that children know what to do if disaster strikes. In Chile, the government has designed a web platform, *Familia Preparada*, which helps parents and children to prepare for a range of risks: volcanic eruption, fire, flood or earthquake. Users can download and print a summary sheet in the form of a cartoon strip that lists the recommended actions and roles each member of the family must adopt.

3. **Alert:** when danger is imminent, everybody must be warned. Even an alert three or four seconds before an earthquake is enough time for people to shelter under a table. What is important is that the protocols for issuing an alert are understood by one and all. Otherwise, there is a high risk due to a lack of responsiveness or, conversely, a widespread panic.

In France, there is a pressing need for a thorough semiological review to overhaul SAIP, the population alert and information system. Currently, as highlighted in the report prepared by senator Pierre Vogel,<sup>1</sup> people no longer understand the siren system and the variants used: is it a flood, earthquake or toxic gas leak? SAIP is obsolete.<sup>2</sup> It is time to decide whether it is better to use a siren, tweet, text message, TV or radio broadcast, or cell broadcasting. Cell broadcasts enable the authorities to display alerts on all cell phones located within any specified area. Many countries have already adopted this French technology, although it is still to find a home in its country of origin.

1 Report on the SAIP, the Population Alert and Information System, by senator Jean-Pierre Vogel, June 28, 2017

2 Update: in May 2018, the French government abandoned use of SAIP for alerting people about terrorist attacks, preferring instead to spread alerts through social media.

## CONCLUSION

*It is very hard to quantify the externalities for disaster simulation exercises, meaning the number of lives saved by preventive measures. However, when a crisis does hit, it is possible to observe the support networks that emerge, people who head out to check on their neighbors, who support an NGO or who are able to call in extra resources to help out.*

*HAND sets out to make local people more aware of risks so that they can act with greater autonomy when facing an imminent threat. In a perfect world, HAND will no longer exist in a few years' time. Once the state is able to deliver civil protection fit for the digital age, to manage social media in emergencies, alert the population in ways that it understands via the most suitable technologies, use drones to survey stricken areas, map and update land and property registers, and get the population accustomed to the risks it faces, then there will be no reason for HAND to exist any longer.*